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FOR

A METHOD OF ASSEMBLING TOGETHER TWO METAL TUBES OF A SEA PIPE-LINE ON A BARGE OR ON LAND, AND OF INSULATING THE ASSEMBLY ZONE, AND TUBES ADAPTED THEREFOR

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A METHOD OF ASSEMBLING TOGETHER TWO METAL TUBES OF A SEA PIPE-LINE ON A BARGE OR ON LAND, AND OF INSULATING THE ASSEMBLY ZONE, AND TUBES ADAPTED THEREFOR

The present invention relates to a method and to apparatus for use on board a barge or on land for assembling together two tubes of a sea pipe-line and for insulating the assembly zone by means of a thermally insulating outer coating that withstands external pressure and is watertight, the coating being obtained by hardening a substance applied onto the tubes.

The time required for the insulating and sealing substance to set is a handicap to laying tubes quickly at sea.

An object of the present invention is to avoid that handicap.

According to the invention, this is achieved by using metal tubes that can be assembled together mechanically to predetermined final relative positions, and prior to assembly, individual insulating and outer sealing coatings are made on the assembly ends of the metal tubes, said coatings being shaped and dimensioned in such a manner that in said predetermined final relative positions they are continuous or quasi-continuous, the tubes are assembled together, and if any residual gap remains between the coatings, it is filled with an adhesive or a sealing compound.

The term "assembled together mechanically" means that they can be assembled together by screwing or by interfitting (as opposed to assembly by welding). By way of example, the compound intended for use at assembled-together ends is based on coal-tar pitch or on polyurethane.

In preferred embodiments:

· the coatings are shaped to present facing front end joint surfaces that are plane and parallel, extending perpendicularly to the axis of the tubes or sloping in one direction or the other;

· the coatings are shaped and dimensioned so as to overlap in part;

· the coatings are shaped so as to present overlapping joint surfaces that are in the form of complementary crenellations or corrugations;

· coatings of elastomer material are used for embodiments with partial overlap;

· the joint surfaces of the coatings are temporarily protected by means of removable caps engaged in or on the assembly ends provided with their coatings and that are withdrawn prior to assembly; and

· after assembly, the assembly zone is surrounded by a heat-shrink sleeve.

Embodiments of coated metal tubes suitable for implementing the method are described below with reference to the figures of the accompanying drawings, in which:

· Figure 1 is an axial section through tubes constituting a first embodiment of the invention and prior to being assembled together;

· Figure 2 is an axial section through the Figure 1 tubes, after the coated tubes have been assembled together;

· Figure 3 is a detail view of the coated-tube assembly zone, in a variant embodiment;

· Figures 4 and 5 are views analogous respectively to those of Figures 1 and 2, for a second variant embodiment; and

· Figures 6 and 7 are views analogous respectively to those of Figures 1 and 2, for a third variant embodiment.

The figures show two metal piping tubes (T1, T2) for assembling together by inserting and fixing a male assembly end of a "male" tube (T1) a certain distance into a female assembly end of the other tube (T2) which is said to be "female".

In the embodiments shown, the female assembly end is defined by a female end (1a) of a connector (1) integrated in the female metal tube (T2) e.g. by screwing, while the male assembly end is defined by one end (2) of the male metal tube (T1) itself.

By way of example, the female assembly end (1a) and the male assembly end (2) both present threads (3, 4) suitable for co-operating to enable the tubes to be assembled together by screwing.

There is no need to describe in greater detail the connector which is of conventional type and is constituted, for example, by a metal bushing defining two opposite cylindrical or frustoconical volumes (1a, 1b) on either side of a stop ring (1c) for receiving respectively one tube end and the other tube end.

In accordance with the invention, prior to being assembled together, the assembly ends of the metal tubes are provided with respective outer coatings (R1, R2) that are leakproof and thermally insulating, being shaped and dimensioned in such a manner that after assembly they leave between them a gap of small or zero thickness.

The coatings are made by molding suitable materials and allowing them to set, for example:

· for solutions without overlap (Figures 1, 2, and 3), materials based on synthetic foam comprising an epoxy or a polyurethane resin associated with a filler that improves its coefficient of insulation (glass microspheres, microspheres of expanded clay, aluminum alloy, titanium, composite fibers, or metal foam);

· for solutions having overlap (Figures 4, 5, 6, and 7) elastomer resin materials of the "hyperlast" or other type, based on silicone or on polyurethane associated with a filler improving its coefficient of insulation of the same type as above.

According to an advantageous feature of the present invention, the assembly ends of the tubes (T1, T2) provided with their outer coating are provided with

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temporary protective caps (5, 6) detachably engaged respectively in the end of the female tube and on the end of the male tube to protect the joint surfaces of the coatings while the tubes are passing over installation rollers or skids.

The various embodiments shown in the drawings differ in the following features:

In the embodiment of Figures 1 and 2, the preformed coatings (R1, R2) are tubes presenting facing end joint surfaces (7, 8) that are annular, plane, parallel, and perpendicular to the axis of the tubes or oblique relative to said axis.

The front end surface (7) of the coating (R2) of the female tube lies substantially in the front end plane (E) of the front end of the connector (1) while the front end surface (8) of the coating (R1) of the male tube lies substantially in the plane (L) defining the rear limit of the insertion zone for said tube into the connector, such that once the tubes have been assembled together, the facing front end surfaces (7, 8) define between them a gap (i) of zero or almost zero width.

In the embodiment of Figure 3, the front end joint surfaces (7, 8) are plane, parallel, and sloping, i.e. oblique relative to the axis of the tubes. They can slope in one direction or the other.

In the embodiments of Figures 4 to 7, the coatings are made of elastomer material and are shaped to present surfaces which overlap once assembled.

For example, one of the coatings defines between itself and the tube which carries it an annular blind gap (9) that is open in a forward direction while the other coating presents an annular projection (10) suitable for penetrating into said gap when the tubes are assembled together.

In the embodiment shown in Figures 4 and 5, it is the coating (R1) of the male tube (T1) that defines a gap (9), while it is the coating (R2) of the female tube (T2)

that presents a projection (10) suitable for being received in the gap, whereas in the embodiment of Figures 6 and 7, it is the coating (R2) of the female tube (T2) that presents a gap (11) cantilevered-out forwards, while the coating (R1) on the male tube (T1) presents a projection (12) suitable for being received in the gap (11).

The shapes of the overlapping joint surfaces (13, 14) of the coatings are complementary in the overlap zone so as to provide sealing that is dry or with the addition of grease, or of adhesive, or of grease-adhesive.

By way of example they can be sinuous (Figures 4 and 5) or stepped (Figures 6 and 7).

Preferably, one of the joint surfaces presents a bulge (15) while the other presents a corresponding indentation (16) (Figures 6 and 7).

A sleeve (M) preferably of heat-shrink material is placed over the assembly zone.

In the examples shown in the drawings, each tube is constituted by an inner metal tube (t_i) and an outer metal tube (t_e) welded to the inner tube and with an insulating material (K) interposed between the two tubes.

A protective material (r) covers the outer tube.

The inner tube projects beyond the outer tube and the coating applied in accordance with the invention covers the projecting portion of the inner tube completely or in part, and covers a portion of the outer tube.

The invention is not limited to this particular tube structure.